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New Cross-linkers for PDMS Networks

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Dielectric electro active polymers (DEAPs) are polymeric network systems that can be used to convert an electrical input to mechanical deformation of a polymer. DEAPs can be applied as actuators, sensors and generators due to their ability to exhibit a change in size and shape when an external voltage is applied as well as generate electrical energy when the material is exposed to mechanically induced deformations. DEAPs are normally constructed from thin filled elastomer films with compliant electrodes on each side. Polydimethylsiloxane (PDMS) is one of the most used materials due to its natural high capacitance and good thermal stability, high efficiency and fast response.

The aim of this work is to design new PDMS networks applicable as DEAPs. One of the most important factors for DEAPs is the capacitance and development of novel materials are focused on increasing this while maintaining good mechanical properties. As PDMS has been used for DEAP applications with good results, it is of interest to do material optimization at the PDMS network cross-linking points as this could lead to material optimization. Design of novel functional cross-linkers can for example allow for incorporation of selected moieties in the network structure which could increase the dielectric permittivity and thereby the capacitance. Functional cross-linkers could also be used for investigation of the network formation and structure through labeling of cross-linking sites.

Potential functional cross-linkers should have selective functional groups to allow for specific cross-linking with PDMS chains at some reactive sites and chemical modification at other reactive sites. An example of a possible cross-linker is the readily available glucose, methyl-α-D-glucopyranoside, which contains four hydroxyl groups; three secondary and one primary. The secondary hydroxyl groups can be used as cross-linking sites for the PDMS chains, thus creating a network structure and the primary hydroxyl group can after chemical modification be used for selective reactions which will allow for specific reaction points in the PDMS network.